Fundamentals of Piano Practice

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Preface

This is the best book ever written on how to practice at the piano! The revelation of this book is that there are highly efficient practice methods that can accelerate your learning rate, by up to 1,000 times if you have not yet learned the most efficient practice methods (see IV.5). What is surprising is that, although these methods were known since the earliest days of piano, they were seldom taught because only a few teachers knew about them and these knowledgeable teachers never bothered to disseminate this knowledge.

I realized in the 1960s that there was no good book on how to practice at the piano. The best I could find was Whiteside's book, which was an utter disappointment; see my review of this book in References. As a graduate student at Cornell University, studying until 2 AM just to keep up with some of the brightest students from all over the world, I had little time to practice piano. I needed to know what the best practice methods were, especially because whatever I was using wasn't working although I had taken piano lessons diligently for 7 years in my youth. How concert pianists could play the way they did was an absolute mystery to me. Was it just a matter of sufficient effort, time, and talent, as most people seem to think? If the answer were "Yes", it would have been devastating for me because it meant that my musical talent was so low that I was a hopeless case because I had put in sufficient effort and time, at least in my youth, practicing up to 8 hours a day on weekends.

The answers came to me gradually in the 1970's when I noticed that our two daughters' piano teacher was teaching some surprisingly efficient methods of practice that were different from methods taught by the majority of piano teachers. Over a period of more than 10 years, I kept track of these efficient practice methods and came to the realization that the most important factor for learning to play the piano is the practice methods. Effort, time, and talent were merely secondary factors! In fact, "talent" is difficult to define and impossible to measure; it had become a meaningless word we use to hide our ignorance of the true definition of effective talent. In fact, proper practice methods can make practically anybody into a "talented" musician! I saw this happen all the time at the hundreds of student recitals and piano competitions that I had witnessed.

There is now a growing realization...
possibly the most prominent example of the "Mozart Effect". Some have renamed this "The Beethoven Effect" which might be more appropriate because Mozart had some personality weaknesses, etc., that sometimes marred his otherwise glorious music, whereas psychologically, Beethoven composed the most enlightening music. Listening to music is only one component of the complex Mozart Effect. For pianists, making music has a larger effect on mental development. Thus good practice methods will not only accelerate the learning rate but also help to develop the musical brain, as well as raise the intelligence level, especially for the young. The learning rate is accelerated, compared to the slower methods (it's like the difference between an accelerating vehicle and one going at a constant speed). Therefore, in a matter of a few years, students without proper practice methods will fall hopelessly behind. This makes those students with good practice methods appear far more talented than they really are because they can learn in minutes or days what it takes the others months or years. The most important aspect of learning piano is brain development and higher intelligence. Memory is a component of intelligence and we know how to improve memory (see III.6). This book also teaches how to play music in our minds – this is called Mental Play (II.12), which naturally leads to absolute pitch and the ability to compose music. These are the skills that distinguished the greatest musicians and led us to label them as geniuses; yet we show here that they are not difficult to learn. Until now, the musician’s world was restricted to the few “gifted” artists; we now know that it is a universe in which we can all participate.

Practice methods can make the difference between a lifetime of futility, and a concert pianist in less than 10 years for young, dedicated students. Using the right practice methods, it takes only a few years for a diligent student at any age to start playing meaningful pieces from famous composers. The saddest truth of the past two centuries has been that, although most of these practice methods were discovered and rediscovered thousands of times, they were never documented and students either had to rediscover them by themselves or, if lucky, learn them from teachers who knew some of them. The best example of this lack of documentation is the "teachings" of Franz Liszt. There are a dozen Franz Liszt societies and they have produced hundreds of publications. Numerous books have been written about Liszt (see Eigeldinger, etc., in References), and thousands of teachers have claimed to teach in his style. But a reference to Liszt in a book does not mean that the author actually had a lesson from him. The most important research is to find out whether the claimed lessons were documented or not. If they were not, then the teacher just invented a story about Liszt. (See Chapter II.12 for a detailed discussion.)

Some people have introduced the term "absolute pitch" to describe the ability to name or match musical pitches without reference to a tuning standard. This term is misleading because it conveys the idea that there is a standard for each pitch that is fixed in the listener’s mind. However, this is not the case. Absolute pitch is not a fixed ability, but rather a process that can be learned and improved through practice. The most effective way to develop absolute pitch is through the use of mnemonic devices, such as organizing pitches into scales or chord progressions. Absolute pitch is not limited to music; it can be applied to other areas of life as well, such as memory enhancement or learning foreign languages. However, some people may have difficulty achieving absolute pitch, especially those with hearing impairments or other sensory processing disorders. In these cases, it may be necessary to use alternative strategies, such as visual or kinesthetic techniques, to aid in learning pitches.
with documented teaching lineages. Yet there is not one publication that describes what that method is! There are endless accounts of Liszt's accomplishments and technical prowess, yet there is not one reference on the details of how he got that way. Evidence in the literature indicates that even Liszt could not describe how he acquired technique; he could only demonstrate how he played. Since piano pedagogy has succeeded in losing track of how the greatest pianist acquired his technique, it is little wonder that we did not have a textbook on learning piano. Can you imagine learning math, economics, physics, history, biology, or anything else without a textbook, and (if you are lucky) only your teacher's memory as a guide? Without textbooks and documentation, our civilization would not have advanced beyond that of jungle tribes whose knowledge base had been passed on by word of mouth. That's basically where piano pedagogy has been for 200 years!

There are many books on learning piano (see References), but none of them qualify as textbooks for practice methods, which is what students need. These books tell you what skills you need (scales, arpeggios, trills, etc.) and the more advanced books describe the fingerings, hand positions, movements, etc., to play them, but none of them provide a reasonably complete, systematic set of instructions on how to practice. Most beginner music books provide a few such instructions, but many of those instructions are wrong -- a good example is the amateurish advertisement on how to become “The Virtuoso Pianist in 60 Exercises" in the title of the Hanon exercises (see section III.7.h of Chapter One). In piano pedagogy, the most essential tool for the teacher and the student -- a reasonably complete set of instructions on how to practice, had been missing until this book was written.

I did not realize how revolutionary the methods of this book were until after I finished my first draft of this book in 1994. These methods were better than what I had been using previously and, for years, I had been applying them with good, but not remarkable, results. I experienced my first awakening after finishing that book, when I really read my own book and followed the methods systematically -- and experienced their incredible efficiency. So, what was the difference between knowing parts of the method and reading a book? In writing the book, I had to take the various parts and arrange them into an organized structure that served a specific purpose and that had no missing essential components. As a scientist, I knew that organizing the material into a logical structure was the only way to write a useful manual. It is well known in
discoveries are made while writing the research reports, not when conducting the research. It was as if I had most the parts of a terrific car, but without a mechanic to assemble the car, find any missing parts, and tune it up, those parts weren't much good for transportation. I became convinced of this book's potential to revolutionize piano teaching and, in 1999, decided to provide it free to the world on the internet. In this way, it could be updated as my research progressed and whatever was written would be immediately available to the public. In retrospect, this book is the culmination of over 50 years of research that I had conducted on piano practice methods since my first piano lessons.

Why are these practice methods so revolutionary? For detailed answers, you will have to read this book. Here, I briefly present a few overviews of how these miraculous results are achieved and to explain why they work. I did not originate most of the basic ideas in this book. They were invented and re-invented umpteen times in the last 200 years by every successful pianist; otherwise, they would not have had such success. The basic framework for this book was constructed using the teachings of Mlle. Yvonne Combe, the teacher of our two daughters who became accomplished pianists (they have won many first prizes in piano competitions and averaged over 10 recitals a year each for many years; both have absolute pitch, and now enjoy composing music). Other parts of this book were assembled from the literature and my research using the internet. My contributions are in gathering these ideas, organizing them into a structure, and providing some understanding of why they work. This understanding is critical for the success of the method. Piano has often been taught like religion: Faith, Hope, and Charity. Faith that, if you followed procedures suggested by a "master" teacher, you will succeed; Hope that, "practice, practice, practice" will lead you to the rainbow, and Charity that your sacrifices and paying your dues will perform miracles. This book is different—a method is not acceptable unless the students understand why it works so that they can adapt it to their specific needs. Finding the correct understanding is not easy as you can't just pluck an explanation out of thin air (it will be wrong)—you must have enough expertise in that field of knowledge in order to arrive at the correct explanation. Providing a correct explanation automatically filters out the wrong methods. This may explain why even experienced piano teachers, whose educations were narrowly

なぜこの練習方法が画期的と言えるのでしょうか？回答の詳細については本書を読んでいただきたいのですが、ここでは、これらの驚くべき結果にどのように至るのかの概略を手短に紹介し、何故それが上手いくくのを説明します。本書の基本的アイデアの殆どは、私が最初に思いついたものではありません。これらの方法は、ピアニストとして成功した人達によって、何度も数え切らないほど発見されたはずです。そうでなければ、彼等の成功はなかったでしょう。本書の基本的骨組みは、イボヌ・クーム女史の教授法に依ります。彼女は、ピアニストとして成功した私の二人の娘のビアノ教師です（娘達は何度もピアノコンテストで優勝し、何年も年に10回以上のライサイタルをこなしでいました。二人とも絶対音感を持ち、現在は作曲を楽しんでいます）。その他の箇所は文献やインターネットからの調査を集めたものです。私が行なったのは、これらのアイデアをまとめ、構成を整理し、何故この方法が効果的なか一見を示したことです。そして、見解を示すことが、この練習方法を成功させるのに必要な不可欠です。ビアノは、今まで、まるで宗教のように：信仰、希望、愛と教えてきました。信仰=主であるピアノ教員のいう通りにすれば、道は開けるでしょう。希望=練習（祈り）なさい、練習（祈り）なさい、練習（祈り）なさい、そうすれば虹を見ることができるでしょう。愛=全体全霊で全てを捧げれば、奇跡が起こるでしょう。本書は違います—どの方法も、ピアノ学習者の各々の必要に応じ、何故それで上手く行くか理解して採択しています。正しい見解を見つけ出すのは容易ではありません。無から解説を引き出すことはできないからです（誤りかもしれませんが）—正しい解説に至るには、その分野の専門知識を全く持たなければならない。正しく解説しようとする際、間違った方法は自動的に淘汰されます。このことは音楽のみに専念してきた経験豊富なピアノ教師にさえ、正しい理解を与えることが難しく、さらに手順は合っていも
and will frequently give wrong explanations for even correct procedures. In this regard, my career/educational background in industrial problem solving, materials science (metals, semiconductors, insulators), optics, acoustics, physics, electronics, chemistry, scientific reporting (I have published over 100 peer-reviewed articles in major scientific journals and have been granted 6 patents), etc., have been invaluable for producing this book. These diverse requirements might explain why nobody else was able to write this type of book. As a scientist, I have agonized over how to concisely define “science” and argued endlessly over this definition with other scientists and non-scientists. Because the scientific approach is so basic to this book, I have included a section on “Scientific Approach to Piano Practice”, IV.2, Chapter One. Science is not just the theoretical world of the brightest geniuses; it is the most effective way to simplify our lives. We need geniuses to advance science; however, once developed, it is the masses that benefit from these advances.

What are some of these magical ideas that are supposed to revolutionize piano teaching? Let’s start with the fact that, when you watch famous pianists perform, they may be playing incredibly difficult things, but they make them look easy. How do they do that? Fact is, they are easy for them! Therefore, many of the learning tricks discussed here are methods for making difficult things easy: not only easy, but often trivially simple. This is accomplished by practicing the two hands separately and by picking short sections to practice, sometimes down to only one or two notes. You can’t make things any simpler than that! Accomplished pianists can also play incredibly fast -- how do we practice to be able to play fast? Simple! By using the "chord attack" (II.9). Thus one key to the success of the methods discussed here is the use of ingenious learning tricks that are needed to solve specific problems.

Even with the methods described here, it may be necessary to practice difficult passages hundreds of times and, once in a while, up to 10,000 times before you can play the most difficult passages with ease. Now if you were to practice a Beethoven Sonata at, say, half speed (you are just learning it), it would take about an hour to play through. Therefore, repeating it 10,000 times would take 30 years, or almost half a lifetime, if you had, say, one hour per day to practice and practiced only this sonata 7 days a week. Clearly, this is not the way to learn the sonata, although many students use practice methods not too different from it. This book describes methods for identifying just the few notes that you
and then playing them in a fraction of a second, so that you can repeat them 10,000 times in a few weeks (or even days for easier material), practicing them for only about 10 minutes per day, 5 days per week – we have reduced the practice time from half a lifetime to a few weeks.

This book discusses many more efficiency principles, such as practicing and memorizing at the same time. During practice, each passage must be repeated many times and repetition is the best way to memorize; therefore, it doesn't make sense not to memorize while practicing, especially because this turns out to be the fastest way to learn. Have you ever wondered how every concert pianist can memorize hours of repertoire? The answer is quite simple. Studies with super memorizers (such as those who can memorize pages of phone numbers) have revealed that they are able to memorize because they have developed memory algorithms onto which they can quickly map the material to be memorized. For pianists, music is such an algorithm! You can prove this by asking a pianist to memorize just one page of random notes, and to remember them for years. This is impossible (without an algorithm) although this pianist may have no trouble memorizing several 20 page Beethoven Sonatas, and still play them 10 years later. Thus what we thought was a special talent of concert pianists turns out to be something anyone can do. Students who use the methods of this book memorize and perform everything they learn, except when practicing sight reading. This is why this book does not recommend exercises such as Hanon and Czerny, that are not meant to be performed; by the same token, the Chopin Etudes are recommended. Practicing something that wasn't meant to be performed is not only a waste of time but also destroys any sense of music you originally had. We discuss all the major methods of memory, which empower the pianist to perform feats that most people would expect only from "gifted musicians", such as playing the composition in your head, away from the piano, or even writing the entire composition from memory. If you can play every note in the composition from memory, there is no reason why you can't write them all down! Such abilities are not for show or bragging rights, but are essential for performing without flubs or memory lapses and come almost as automatic byproducts of these methods, even for us ordinary folks with ordinary memory. Many students can play complete compositions but can't write them down or play them in their minds -- such students have only partially memorized the compositions in a manner...
insufficient for performances. Inadequate memory and lack of confidence are the main causes of nervousness. They wonder why they suffer stage fright and why performing flawlessly is such a daunting task while Mozart could just sit down and play.

**Another example of helpful knowledge is relaxation and the use of gravity.** The weight of the arm is important not only as a reference force for uniform and even playing (gravity is always constant), but also for testing the level of relaxation. The piano was designed with gravity as the reference force because the human body evolved to match gravity exactly, which means that the force needed to play the piano is about equal to the weight of the arm. When performing difficult tasks, such as playing a challenging piano passage, the natural tendency is to tense up so that the entire body becomes one contracted mass of muscle. Trying to move the fingers independently and rapidly under such conditions is like trying to run a sprint with rubber bands wrapped around both legs. If you can relax all unnecessary muscles, and use only the required muscles for just those instants at which they are needed, you can play extremely fast, effortlessly, for long periods of time without fatigue, and with more reserve strength than needed to produce the loudest sounds.

**We will see that many “established teaching methods” are myths that can cause untold misery to the student.** Such myths survive because of a lack of rigorous scientific scrutiny. These methods include: the curled finger position, thumb under method of playing scales, most finger exercises, sitting high on the chair, “no pain, no gain”, slowly ramping up your speed, and liberal use of the metronome. We not only explain why they are harmful but also provide the correct alternatives, which are, respectively: flat finger positions, thumb over method, parallel sets (II.11, III.7b), sitting lower on the chair, relaxation, acquiring speed by understanding "speed walls" (III.7i) and identification of specific beneficial uses of the metronome. Speed walls are encountered when you try to play a passage faster, but reach a maximum speed beyond which the speed will not increase no matter how hard you practice. What causes speed walls, how many are there, and how do you avoid or eliminate them? Answers: speed walls are the results of attempts to do the impossible (you erect speed walls yourself by using incorrect practice methods), there are effectively an infinite number of them, and

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他に知っておくと役立つのは、脱力と重力を利用です。（重力は一定なので）腕の重さは音のつぶを揺さべて弾いているかどうかの基準になり大切ですが、それだけではなく、脱力のレベルを知るのにも大切です。ピアノは重力を基準としてデザインされています、というのも、ヒトの体が重力にぴったり適応するように進化してきたからです。言い換えると、ピアノを弾くのに必要な力と腕の重さは、ほぼ等しいのです。難易度の高いことをしようとする時、例えば難しいパッセージを弾く時に、体全体がひとつの縮まった筋肉の塊のように緊張してしまうのは自然なことです。しかし、このような状態で、自由自在に速く指を動かそうとするのは、両脚にゴム帯を巻き付けたままで全力疾走しようとするようなものです。もし、使わない筋肉をリラックスさせ、使いたい筋肉を使いたい時にだけ使えれば、速く、無理なく、疲れることなく長い時間演奏することが出来ますし、最大の音量が必要な箇所に備えて、より多くの力を蓄えておくことができます。

“確立された教授法”の中には、ピアノ学習者に甚大な被害を与えかねない神話も多くあります。このような神話は、きちんと吟味を受けていないため、未だに廃れていません。例を挙げると、指を丸く戸を持つような形で置く、スケールを弾く際に親指をくぐらせ、指のエクササイズの殆ど全て、椅子に高く腰掛け、「痛みしなくて得るもののなし」、速く弾くには少しずつ、メトロノームをいつも使うなどです。私達はそれが有効である理由だけでなく、正しい選択肢についても述べています。上述の例ですと、指は平置く、親指はぐるない、パラレルセット（II.11, III.7b）、椅子は低く、脱力、速く弾くには“速さの壁”（III.7i）を理解して、メトロノームの有益な使い方はです。あるパッセージを速く弾こうとしているのに、どんなに一生懸命練習してもそれ以上速くは弾けなくなった際、速さの壁に直面したといえます。速さの壁の原因は何でしょうか、いくらあるのでしょうか、どうやって避けたり取り除いたりできるのでしょうか？　回答：速さの壁は出来ないことをしようとした結果です（誤った練習方法によって、自分自身で速さの壁を作ってしまっています）。事実上、無数にありますが、正しい練習方法を使うことで避けることができます。最初から速さの壁を避けるためにできるこ
build them in the first place, by knowing their causes (stress, incorrect fingering or rhythm, lack of technique, practicing too fast, practicing hands together [II.25] before you are ready, etc.). Another way is to come down in speed from “infinite speed” by using the parallel sets (II.11), instead of increasing the speed gradually. If you can start at speeds above the speed wall, there is no speed wall when you come down in speed.

This book frequently deals with one important point -- that the best piano practice methods are surprisingly counter-intuitive. This point is paramount in piano pedagogy because it is the main reason why the wrong practice methods tend to be used by students and teachers. If they weren't so counter-intuitive, this book may not have been necessary. Consequently, we deal not only with what you should do but also with what you should not do. These negative sections are not for criticizing those who use the wrong methods but are necessary components of the learning process. The reason why intuition fails is that the piano tasks are so complex, and there are so many ways to accomplish them, that the probability of hitting the right method is nearly zero if you picked the simplest, obvious ones. Here are four examples of counter-intuitive practice methods:

(1) Separating the hands for practice (II.7) is counter-intuitive because you need to practice each hand, then both together, so that it looks like you have to practice three times instead of just once hands together. Why practice hands separately, which you will never use in the end? Approximately 80% of this book deals with why you need to practice hands separately. Hands separate practice is the only way to rapidly increase speed and control without getting into trouble. It allows you to work hard 100% of the time at any speed without fatigue, stress, or injury because the method is based on switching hands as soon as the working hand begins to tire. Hands separate practice is the only way in which you can experiment to find the correct hand motions for speed and expression and it is the fastest way to learn how to relax. Trying to acquire technique hands together is the main cause of speed walls, bad habits, injury, and stress.

(2) Practicing slowly hands together and gradually ramping up the speed is what we tend to do intuitively, but it turns out to be one of the worst ways to practice because it wastes so much time and you are training the hands to execute slow motions that are different from what you need at the final speed wall. In other words, when you can start at speeds above the speed wall, there is no speed wall when you come down in speed.

(3) Practicing three times instead of just once hands together (II.7) is counter-intuitive because you need to practice each hand, then both together, so that it looks like you have to practice three times instead of just once hands together. Why practice hands separately, which you will never use in the end? Approximately 80% of this book deals with why you need to practice hands separately. Hands separate practice is the only way to rapidly increase speed and control without getting into trouble. It allows you to work hard 100% of the time at any speed without fatigue, stress, or injury because the method is based on switching hands as soon as the working hand begins to tire. Hands separate practice is the only way in which you can experiment to find the correct hand motions for speed and expression and it is the fastest way to learn how to relax. Trying to acquire technique hands together is the main cause of speed walls, bad habits, injury, and stress.

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by using the metronome as a constant guide to ramp up the speed or to keep the rhythm. This is one of the worst abuses of the metronome. Metronomes should be used only briefly to check the timing (speed and rhythm). If overused, it can lead to loss of your internal rhythm, loss of musicality, and bio-physical difficulties from overexposure to rigid repetition (the brain can actually start to counteract the metronome click and you may either not hear the click or hear it at the wrong time). Technique for speed is acquired by discovering new hand motions, not by speeding up a slow motion; i.e., the hand motions for playing slowly and fast are different. This is why trying to speed up a slow motion leads to speed walls -- because you are trying to do the impossible. Speeding up a slow play is like asking a horse to speed up a walk to the speed of a gallop -- it can't. A horse must change from walk to trot to canter and then to gallop. If you force a horse to walk at the speed of a canter, it will hit a speed wall and will most likely injure itself by kicking its own hoofs to shreds.

(3) In order to memorize well, and be able to perform well, you must practice slowly, even after the piece can be played easily at speed. This is counter-intuitive because you always perform at speed, so why practice slowly and waste so much time? Playing fast can be detrimental to performance as well as to memory. Playing fast can cause “fast play degradation”, and the best way to test your memory is to play slowly. Thus practicing the recital pieces at full speed on recital day will result in a poor performance. This is one of the most counter-intuitive rules and is therefore difficult to follow. How often have you heard the refrain, "I played awfully during my lesson although I played so well this morning."? Therefore, although much of this book is oriented towards learning to play at the correct speed, it is the proper use of slow play that is critical for accurate memorization and for performing without mistakes. However, practicing slowly is tricky because you should not practice slowly until you can play fast! Otherwise, you would have no idea if your slow play motion is right or wrong. This problem is solved by practicing hands separately and getting up to speed quickly. After you know the hand motions for fast play, you can practice slowly at any time.

(4) Most people feel uncomfortable trying to memorize something they can't play, so they instinctively learn a piece first, and then try to memorize it. It turns out that you can save a lot of time by memorizing first and then practicing from memory (we are talking about
challenging music that is too difficult to sight read. Moreover, for reasons explained in this book, those who memorize after learning the piece never succeed in memorizing well. They will be haunted forever by memory problems. Therefore, good memorizing methods must be an integral part of any practice procedure; memorizing is a necessity, not a luxury.

These four examples should give the reader some idea of what I mean by counter-intuitive practice methods. What is surprising is that the majority of good practice methods is counter-intuitive to most people. Fortunately, the geniuses who came before us have found the better practice methods and you will see them here.

Why does the fact, that the correct methods are counter-intuitive, lead to disaster? Even students who learned the correct methods (but were never taught what not to do) can drift back into intuitive methods simply because their brains keep telling them that they should use the intuitive methods (that's the definition of intuitive methods). This of course happens to teachers as well. Parents fall for it every time! Thus mere parental involvement can sometimes be counterproductive, because the parents must also be informed. This is why this book makes every effort to identify, and to point out the follies of, the intuitive methods. Thus many teachers discourage parental involvement unless the parents can also attend the lessons. Left to their own devices, the majority of students, teachers, and parents will gravitate towards the intuitive (wrong) methods. This is the main reason why so many wrong methods are taught today, and why students need informed teachers and proper textbooks. All piano teachers should use a textbook that explains practice methods; this will free them from having to teach the mechanics of practicing and allow them to concentrate on music where the teachers are most needed. The parents should also read the textbook because parents are most susceptible to the pitfalls of intuitive methods.

Piano teachers generally fall into three categories: (A) private teachers who can't teach, (B) private teachers that are very good, and (C) teachers at universities and conservatories. The last group is usually fairly good because they are in an environment in which they must communicate with one another. They are able to quickly identify the worst teaching methods and eliminate them. Unfortunately, most students at conservatories are already quite advanced and so it is too late to teach them basic practice methods. The (A) group of...
use mostly intuitive methods; this explains why they can't teach. By choosing only teachers that have web sites, you can eliminate many of the poor teachers because these have at least learned to communicate. Groups (B) and (C) are fairly familiar with the correct practice methods, though few know all of them because there has not been a standardized textbook; on the other hand, most of them know a lot of useful details that aren't in this book. There are precious few group (B) type teachers and the group (C) teachers generally accept only advanced students. The problem with this situation is that most students start with the group (A) teachers and never progress beyond novice or intermediate level and therefore never qualify for the group (C) teachers. **Thus the majority of beginner students give up in frustration although practically all of them have the potential to become accomplished musicians.** Moreover, this lack of progress feeds the general misconception that learning piano is a lifetime of fruitless efforts, which discourages the majority of parents and youngsters from considering piano lessons.

There is an intimate relationship between music and mathematics. Music, in many respects, is a form of mathematics and the great composers explored and exploited this relationship. Most basic theories of music can be expressed using mathematical terms. Harmony is a series of ratios, and harmony gives rise to the chromatic scale, which is a logarithmic equation. Most music scales are subsets of the chromatic scale, and chord progressions are the simplest relationships among these subsets. I discuss some concrete examples of the use of mathematics in some of the most famous compositions (section IV.4) and include all the topics for future music research (mathematical or otherwise) in Section IV. It does not make sense to ask whether music is art or math; they are both properties of music. Math is simply a way of measuring something quantitatively; therefore, anything in music that can be quantified (such as time signature, thematic structure, etc.) can be treated mathematically. Thus, although math is not necessary to an artist, music and mathematics are inseparably intertwined and a knowledge of these relationships can often be useful (as demonstrated by every great composer), and will become more useful as mathematical understanding of music progressively catches up to music and as artists learn to take advantage of mathematics. Art is a shortcut way of using the human brain to achieve results not achievable in any other way. Scientific approaches to music only deal with the simpler levels of music that can be analytically treated: science supports art. It is wrong to assume that science will eventually

で、ダメな教師をかなり除外できます。ウェブサイトを持つ教師には少なくともコミュニケーション能力はあるということですから。B)と(C)のグループの教師は適切な方法について、それなりの知識を持ちますが、全て知っている人は稀です。なぜなら標準化された教科書はつってなかったからです；しかし彼の一方、彼等の皆さんが本書には載っていないような役に役立つ情報の詳細を知っています。数少ない貴重な(B)グループのピアノ教師と(C)グループの教員は、一般に上級者しか採用しません。つまり現実問題として、ピアノの習い始めは(A)グループの教師に就くことになるので、上達も初心者かせいぜい中級レベルに留まることになります。それ故、(C)グループの教員に就ける上級者にはなることができません。こうして、実際には全て人が音楽家として成功する可能性を持つのに、大多数のピアノ学習者を初級のまま業を喰おして詰めていません。これに加えて、ピアノを習っても無駄という誤解に上達のつながりが拍子をかけ、多くの親や若者からピアノレッスンへのやる気を削ぐのです。

音楽と数学の間には密接な関係があります。音楽は多くの面で数学の形であり、優れた作曲家達は、この関係を探求し、活用したのです。基本的な音楽理論は殆ど全てにわたって、数学用語を使って表現することができます。和声は一連の比で、和声は半音階をもたらしますが、この半音階は対数式で表されます。様々な音階は半音階の一部であることが殆どであり、それぞれの音階の中で、一番シンプルな関係性をもつのがコード進行です。セクション IVでは、良く知られている曲の中から幾つか選んで、数学の利用の具体例について述べ（セクション IV.4）、今後の音楽研究（数学に関しては）のため特にトピックの全てを包括しました。音楽が芸術なのか数学なのか問うのは意味をなしません；どちらとも音楽の特性です。数学は単に何かを定量する手段ですから、音楽に関するで測定できるものは何でも（例えば拍子記号や主題構成など）数学的に扱うことができるのです。数学は音楽家に欠かせない訳ではないのですが、音楽と数学とは切っても切り離せない関係があり、これらの関係性に関する知識はしばしば（あらゆる偉大な作曲家が立証しようのように）役立ち、音楽の数学的説明が進むにつれて、また音楽家が数学の利用を学ぶことで、ますます役立つようになります。芸術は他の方法に真似できない結果を人間の脳にもたらす近道でもありました。音楽への科学的アプローチは、分析できるシンプルな音楽しか取り扱うことができませんが、それでも科学は芸術をサポートします。科学が芸術にとって代わることはありませんし、逆に芸術だけが音楽に必要な全てというわけでもありません；芸術
Too many pianists are ignorant of how the piano works and what it means to tune in the temperaments, or what it means to voice the piano. This is especially surprising because piano maintenance directly affects (1) the ability to make music and (2) technical development. There are many concert pianists who do not know the difference between Equal (P. 224) and Well temperaments (P. 226) while some of the compositions they are playing (e.g. Chopin, Bach) formally require the use of one or the other. When to use electronic pianos, when to change to a higher quality (grand) piano, and how to recognize quality in a piano are critical decisions in the career of any pianist. Therefore, this book contains a section on piano selection and a chapter on how to tune your own piano. Just as electronic pianos are already always in tune, acoustic pianos must soon become permanently in tune, for example, by using the thermal expansion coefficient of the strings to electronically tune the piano (see Gilmore, Self-Tuning Piano). Today, practically all home pianos are out of tune almost all the time because it starts to go out of tune the moment the tuner leaves your house or if the room temperature or humidity changes. That's an unacceptable situation. In future pianos, you will flick a switch and the piano will tune itself in seconds. When mass produced, the cost of self-tuning options will be small compared to the price of a quality piano. You might think that this would put piano tuners out of work but that will not be the case because the number of pianos will increase (because of this book), the self-tuning mechanism requires maintenance and, for pianos in such perfect tune, frequent hammer voicing and regulation (that are too often neglected today) will make a significant improvement in musical output. This higher level of maintenance will be demanded by the increasing number of advanced pianists. You might suddenly realize that it was the piano, not you, that limited technical development and musical output (worn hammers will do it every time)!. Why do you think concert pianists are so fussy about their pianos?

In summary, this book represents an unique event in the history of piano pedagogy and is revolutionizing piano teaching. Surprisingly, there is little that is fundamentally new in this book. We owe most of the major concepts to Yvonne (Combe), Franz, Freddie, Ludwig, Wolfie, Johann, etc. Yvonne and Franz gave us hands separate practice, segmental practice and relaxation; Franz and Freddie

是芸術家の心踏くままに具体化されるべきです。科学は計り知れないほどの援助を芸術に与えることができるのです。

ピアノの仕組みや、音律に合う調律の意味、ピアノの音の意味について無知なピアニストが多過ぎます。ピアノのメンテナンスは直接影響を（1）音楽を生み出す能力、（2）テクニックの向上に与えるので、これは非常に驚くべきことです。平均率（P. 224）とウェル・テンペラメント（P. 226）の違いを知らないコンサートピアニストは沢山いますが、彼等が弾く曲のいくつか（ショパンやベッハなど）正式にはどちらかを用いるのが必須なのです。いつもピアノを使うか、いつも上位の（グランド）ピアノに替えるか、どうピアノの質を見極めるか、それらどのピアニストにもキャリアを左右する重要な決断です。そこで、本書はピアノ選びのセクションと自分のピアノの調律の仕方についてのセクションを設けています。既に電子ピアノの音が常に合っているように、弦の熱膨張率を使い電子的に調律（ギルモアの自己調律ピアノ参照）するなどして、アコースティックピアノもずっと音の合った状態を保つ時代が直ぐに来なくてはなりません。現在、実際問題として、全家庭のピアノはほぼ常時音が外れており、なぜなら調律師が家を出た途端、温度や湿度が変化した途端に音ずれ始めるからです。これは容認できない状況です。未来的なピアノは、スイッチを押すと秒数で自己調律を完了するでしょう。大量生産なら、良質のピアノの価格に占める自己調律オプションの価値は小なものです。これで調律師が仕事を失うと考える方もいらっしゃるかもしれません。そうではありません。ピアノの数（本書のおかげで）増えますし、自己調律装置はメンテナンスが必要です。さらに完璧な音の合ったピアノでは頻繁なハンマーの整音と整調（今はがしろにされることが多過ぎます）が音楽性に飛躍的改善を与えます。つまり高度なメンテナンスがピアノ上級者の増加によって必要とされます。テクニックの向上や音楽性の表現を妨げていたのは、あなたではなくピアノだ（摩耗したハンマーはいつもそうです！）と気づくかもしれません。コンサートピアニストがピアノにどうもうるさいのは何故でしょうか？

要するに、本書はピアノ教授法の歴史に一石を投じ、ピアニスト指導を根本的に変えるものです。しかし驚くことに、根本的に新しいことは、本書には殆どありません。主な概念の殆どは、イボヌス（クーム）、フランス、フレディ、ルーディヒ、ウォルフィ、ヨハンから拝借しています。イボヌスとフランスから片手練習、分節練習、脱力を、フランスとフレディからは“親指をくらさない”方法とノーマンやツェルニーからの解放を；ウォルフィからは
play; Johann knew all about parallel sets, quiet hands (III.6.1), and the importance of musical practice, and they all showed us (especially Ludwig) the relationships between math and music. The enormous amounts of time and effort that were wasted in the past, reinventing the wheel and futilely repeating finger exercises with every generation of pianist, stagers the imagination. By making the knowledge in this book available to the student from day one of piano lessons, we are ushering in a new era in learning to play the piano. This book is not the end of the road -- it is just a beginning. Future research into practice methods will undoubtedly uncover improvements; that's the nature of the scientific approach. It guarantees that we will never again lose useful information, that we will always make forward progress, and that every teacher will have access to the best available information. We still do not understand the biological changes that accompany the acquisition of technique and how the human (especially the infant) brain develops. Understanding these will allow us to directly address them instead of having to repeat something 10,000 times. Since the time of Bach, piano pedagogy had been in a state of arrested development; we can now hope to transform piano playing from a dream that seemed mostly out of reach to an art that everyone can now enjoy.

暗譜とメンタルマルプレイを；ヨハンはパラレルセット、静かな手(III.6.1)、そして音楽性の練習の重要さを、彼等全員（特にルーディッヒ）からは、数学と音楽の関係性について学びました。過去には莫大な時間と努力が無駄に費やされてきました。まるで車輪の再発明のような無意味な指のエクササイズム世代のピアニストによって繰り返されてきたことは、呆れ返るばかりです。ピアノレッスンの初日から本書の知識を得られるようならば、ピアノ習得の新しい時代がやってきます。この本は道の終わりではありません--ほんの始まりです。練習方法についての今後の研究は間違いなく改善することでしょう；これは科学的アプローチの特質です。そしてそれは、有用な情報を二度と失わないこと、進歩して行くこと、全てのピアノ教師が最良の情報を入手できることを約束するものです。私達が未だ理解していないのは、テクニックに習熟に伴う生物学的変化や、ヒト（特に乳幼児）の脳の発達についてです。これらについての理解は、一万回の繰り返し練習の代わりに真正面からの問題解決への取り組みを許すでしょう。バッハの時代から、ピアノ教授法は発達が停止したままの状態に陥っています；しかし遂に、ピアノを弾くということが、手の届かない夢から誰でも楽しめる芸術へと変わると期待できるようになったのです。
This book is my gift to society. The translators have also contributed their precious time. Together, we are pioneering a web-based approach for providing free education of the highest caliber, something that will hopefully become the wave of the future. There is no reason why education can't be free. Such a revolution might seem to put some teachers' jobs in jeopardy, but with improved learning methods, piano playing will become more popular, creating a greater demand for teachers who can teach, because students will always learn faster under a good teacher. The economic impact of this improved learning method can be significant. This book was first printed in 1994 and the web site was started in 1999. Since then, I estimate that over 10,000 students had learned this method by year 2002. Let's assume that 10,000 serious piano students save 5 hours/week using these methods, that they practice 40 weeks/year, and that their time is worth $5/hour; then the total yearly savings are:

\[
(5 \text{hrs/wk/student})(40 \text{wks/yr})(5 \text$/hr)(10,000 \text{ students}) = 10,000,000 \text{/yr}, \text{ in 2002, which will increase every year,}
\]

or $1,000 per year per student.

$10M/yr is only the savings of the students; we have not included the effects on teachers and the piano and music industries. Whenever adoption of scientific methods produced such leaps in efficiency, the field has historically flourished, seemingly without limit, and benefited everyone. With a world population over 6.6B today (2007), we can expect the pianist population to eventually exceed 1% or over 66M, so that the potential economic impact of this book could exceed several $B/year. Such huge economic benefits in any sector have historically been an unstoppable force, and this engine will drive the coming piano revolution. This book is the beginning of that revolution. More importantly, music and any gain in the development of a young child’s mind, are priceless.

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1千万ドルはピアノ学習者一人当たりでは1000ドルになります。
Outlining is a method for accelerating the learning process by simplifying the music. It allows you to maintain the musical flow or rhythm, and to do this at the final speed almost immediately. This enables you to practice musically long before that segment can be played satisfactorily or at speed. It helps you to acquire difficult technique quickly by teaching the larger playing members (arms, shoulders) how to move correctly; when this is accomplished, the smaller members often fall into place more easily. It also eliminates many pitfalls for timing and musical interpretation errors. The simplifications are accomplished by using various devices, such as deleting "less important notes" or combining a series of notes into a chord. You then get back to the original music by progressively restoring the simplified notes. Whiteside has a good description of outlining on P.141 of the first book, and P.54-61, 105-107, and 191-196 of the second book, where several examples are analyzed.

For a given passage, there are many ways to simply the score, and a person using outlining for the first time will need some practice before s/he can take full advantage of the method. It is obviously easiest to learn outlining under the guidance of a teacher. The idea behind outlining is that, by getting to the music first, the technique will follow more quickly because music and technique are inseparable. In practice, it requires a lot of work before outlining can become useful. Unlike HS practice, etc., it cannot be learned so easily. Use it only when absolutely necessary (where other methods have failed). It can be helpful when you find it difficult to play HT after completing the HS work. Outlining can also be used to increase the precision and improve the memorizing.

I will demonstrate two very simple outlining examples. Common methods of simplification are (1) deleting notes, (2) converting runs, etc., into chords, and (3) converting complex passages into simpler ones. An important rule is: although the music is simplified, retain the same fingering that was required before the simplification.

Chopin's music often employs tempo rubato and other devices that require exquisite control and coordination of the two hands. In his Fantaisie Impromptu (Op. 66), the six notes of each LH arpeggio (e.g., C#3G#3C#4E4C#4G#3) can be simplified to two notes (C#3E4, played with 51). There should be no need to simplify the RH. This is a good way to make sure that all notes from the two hands are played "together."
together. Also, for students having difficulty with the 3-4 timing, this simplification will allow play at any speed with the difficulty removed. By first increasing the speed in this way, it may be easier to pick up the 3-4 timing later, especially if you cycle just half a bar.

The second application is to Beethoven's Sonata #1 (Op. 2, No. 1). I noted in the Reference that Gieseking was remiss in dismissing the 4th movement as "presenting no new problems" in spite of the difficult LH arpeggio which is very fast. Let's try to complete the wonderful job Gieseking did in getting us started on this Sonata by making sure that we can play this exciting final movement.

The initial 4 triplets of the LH can be learned by using parallel set exercises applied to each triplet and then cycling. Parallel set exercise #1 is useful here (play the triplets as chords) and practice relaxing. The first triplet in the 3rd bar can be practiced in the same way, with the 524524 . . . fingering. Here, I have inserted a false conjunction to permit continuous 524 cycling, in order to work on the weak 4th finger. When the 4th finger becomes strong and under control, add the real conjunction, 5241. Here, TO is required. Then practice the descending arpeggio, 5241235. Practice the ensuing ascending arpeggio using the same methods, but be careful not to use TU in the ascending arpeggio as this is easy to do. Remember the need for supple wrists for all arpeggios. For the RH, you can use the rules for practicing chords and jumps (sections 7.e and 7.f above). So far, everything is HS work.

In order to play HT, use outlining. Simplify the LH and play only the beat notes (starting with the 2nd bar): F3F3F3F2E2F2F3, with fingering 55515551, which can be continually cycled. These are the first notes of each triplet. When this is mastered HS, you can start HT. Once this HT becomes comfortable, adding the triplets will be easier, and you can do it with much less chance of incorporating mistakes. Since these arpeggios are the most challenging parts of this movement, by outlining them, you can now practice the entire movement at any speed.

In the RH, the first 3 chords are soft, and the second 3 are forte. In the beginning, practice mainly accuracy and speed, so practice all 6 chords softly until this section is mastered. Then add the forte. To avoid hitting wrong notes, get into the habit of feeling the notes of the chords before depressing them. For the RH octave melody of bars 33-35, be sure not to play with any crescendo, especially the

次の適用はベートーヴェンのソナタ第1番（作品2,第1番）です。第4楽章に高難度の左手高速アルペジオがあるのに、ギーゼンクがこれを「問題なし」として取り上げなかったのは不備であると、私は参考文献欄に記しました。このソナタを始めるにあたって、駆け足の最終楽章を確実にモニにして、ギーゼンクの素晴らしい仕事を完成させましょう。

元の3連符4つは、各3連符にパラレルセットを充て、それを繰り返すことで習得できます。パラレルセット1（3連符を和音として弾く）がここで役立ちます。リラックスして練習しましょう。3小節目の3連符も同様に、524524の連指で練習できます。弱い第4指を鍛えるため、ここでは敢えて542の連指を繰り返し導入します。第4指が強くならなリコントロールが利くようになったら、本来の5241を加えます。指はぐらせません。それから下降アルペジオを5241235で練習します。上昇アルペジオも同じように練習しますが、上昇アルペジオでは親指をくぐらせてしまいまうので、そうならないように注意してください。全てのアルペジオには柔軟な手首が必要であることを念頭に置いてください。右手には和音と跳躍の練習ルールが使えます（セクション7.eと7.f）。ここまでは全て片手練習で行ないます。

両手で弾くには、アウトライニングを用います。左手を单纯化し、ピートのみを刻みます：具体的には（2小節目から始めると）F3F3F3F2E2F2F3を55515551の指使いで繰り返すことになります。弾くのは各3連符の最初の音です。片手をマスターしてから、両手始めましょう。一旦両手で楽に弾けるようになれば、3連符を加えるのは簡単で、両手がパラパラになるような間違えばぐっと滅ります。この楽章ではこのアルペジオの部分が一番難しく、ここをアウトライニングすることで、どんな速さででもこの楽章を通じて弾けるようになります。

右手部分をみると、最初の和音3つは小さく、次の和音3つはフォルテです。最初のうち、主に正確に速く弾く練習をするので、これをマスターするまで6和音を全て小さく練習し、その後フォルテに加えます。間違った音の打鍵を避けるため、和音を押さえる前に鍵を感じるよう習慣づけましょう。33-35小節目の右手オクターブ旋律、特に
For technique acquisition, the other methods of this book are usually more effective than outlining which, even when it works, can be time consuming. However, as in the Sonata example above, a simple outlining can enable you to practice an entire movement at speed, including most of the musical considerations. In the meantime, you can use the other methods of this book to acquire the technique needed to "fill in" the outlining.

9. Polishing a Piece - Eliminating Flubs
There are 5 things we want to accomplish when polishing a "finished" piece: ensure good memory, eliminate flubs, make music, further develop technique, and prepare for performances. The first step is to ensure memory and we saw in III.6 that the best way is to play the entire piece in your mind, away from the piano. Mental play (MP) guarantees that the memory is practically infallible. If some parts are slightly shaky, you can work on them at any time, even away from the piano. MP is the most secure memory because it is pure mental memory: it is not dependent on aural, tactile, or visual stimuli. It also eliminates most flubs because flubs originate in the brain. Let's look at a few common causes of flubs. Blackouts occur because of too much dependence on hand memory. Stuttering is a habit formed by stopping at every mistake while practicing HT without sufficient HS practice. You hit wrong notes because the hands are not always feeling the keys and you lose track of where the keys are. Missing notes result from lack of relaxation and inadvertent lifting of the hands -- a habit that is usually acquired from too much slow HT practice. We have discussed solutions that eliminate all these sources of mistakes. Finally, playing musically and bringing out the "color" of the composition is the ultimate task in polishing. You can't just play the notes accurately and expect music and color to magically appear -- you must actively create them in your mind before playing the notes -- MP allows you to do all this. If the fingers can't reproduce these mental images, perhaps the piece is too difficult. You will develop technique faster by practicing pieces that you can polish to perfection. However, don't give up too

G音は、少しもクレッシェンドになることがないように弾きましょう。このソナタは全パートをを通して、当然、ペダルなしで弾きます。最後で大失敗しないために、第4楽章の左手の終わりの4音は、事前にその位置にしっかり置いておきましょう。

テクニックを身につけるには、通常、本書の他の方があがる、あるいはすぐにアウトラインニングより役立ちます。
しかし、上述のソナタの例のように、シンプルなアウトラインニングを行うことで、音楽性をあまり損なわずに、楽章全てを楽譜通りの速さで練習することができます。そうしている間に、アウトラインニングされたものの手中を楽譜通りに“満たす”のに必要なテクニックを身につけるため、本書に書かれた他の方法を用いることができるというわけです。
easily because the cause of the difficulty may not lie with you but with some other factor, such as the quality or condition of the piano.

A large part of polishing is attention to detail. The best way to ensure correct expression is to go back to the music and review every expression mark, staccato, rest, notes that are held down, lifting of the finger or pedal, etc. These will give you the most accurate picture of the logical construct of the music that is needed to bring out the proper expressions. The weaknesses of each individual are different, and are often not evident to that individual. A person whose timing is off usually cannot hear the incorrect timing. This is where teachers play key roles in detecting these weaknesses.

Making music is the most important part of polishing a piece. Some teachers emphasize this point by saying that you use 10% of your time learning technique and 90% of the time learning to make music. Most students use over 90% of their time struggling with technique in the mistaken belief that practicing what you can't play will develop technique. This mistake arises from the intuitive logic that if you practice anything you can't play, you should eventually be able to play it. But this is true only for material that is within your skill level. For material that is too difficult, you never know what is going to happen, and frequently such an attempt will lead to irreversible problems such as stress and speed walls. For example, if you want to increase speed, the fastest way is to play easy pieces that you have polished and to speed up that play. Once the finger speed increases, then you are ready to play more difficult material at faster speed. Thus the polishing time is also the best time for technical development, and it can be a lot of fun.

Perfecting your performance skills is part of polishing; this will be discussed in section 14 below. Many pianists experience the following strange phenomenon. There are times when they can do no wrong and can play their hearts out with no mistakes or difficulties. At other times, any piece becomes difficult and they make mistakes where they normally have no problems. What causes these ups and downs? Not knowing which one you will experience can be a terrifying thought that can cause nervousness. Obviously, there are many factors, such as FPD and judicious use of slow play, etc. However, the most important factor is mental play (MP). All pianists use some MP whether they consciously do it or not. The performance often hinges on the quality of that MP. Unless you conduct MP consciously, you never know what
condition it is in. For example, practicing a new piece will confuse the MP of another piece. This is why it is so important to know what MP is, establish good MP, and know when to review/maintain it. If your MP had deteriorated for some reason, reviewing it before a performance will alert you to the impending danger and give you a chance to repair the damage.

A common problem is that students are always learning new pieces with no time to polish pieces. This happens mostly to students using the intuitive learning methods. It takes such a long time to learn each piece that there is no time to polish them before you have to start another piece. The solution, of course, is better learning methods.

In summary, solid mental play is the first requisite for polishing a piece and preparing it for performances. Advanced technique is acquired not only by practicing new skills, but also by playing finished pieces. In fact practicing new skills all the time is counter productive and will lead to speed walls, stress, and non-musical play.